

This document is a portion of the *Draft Cruise Ship Discharge Assessment Report (Draft Report)*, published on December 20, 2007. The reference number is EPA 842-R-07-005. The entire *Draft Report* can be accessed at

http://www.epa.gov/owow/oceans/cruise_ships/disch_assess.html.

Draft Cruise Ship Discharge Assessment Report

Draft Report Cover
Acknowledgments and Disclaimer
Table of Contents
List of Figures and Tables

December, 2007



Draft Cruise Ship Discharge Assessment Report

U.S. Environmental Protection Agency

Oceans and Coastal Protection Division Office of Wetlands, Oceans, and Watersheds

Office of Water 1200 Pennsylvania Avenue, NW Washington, D.C. 20460

December 2007

ACKNOWLEDGMENTS AND DISCLAIMER

Today's Draft Report does not substitute for any statute or regulation, nor is it a regulation itself. The document assesses five primary cruise ship wastestreams, specifically, sewage, graywater, bilge water, solid waste, and hazardous waste. For each wastestream, the Draft Report discusses: the nature and volume of the wastestream generated; existing federal regulations applicable to the wastestream; environmental management, including treatment, of the wastestream; potential adverse environmental impacts of the wastestream; and actions by the federal government to address the wastestream. The Draft Report includes a discussion the existing federal regulations application to each wastestream to illuminate the Agency's current thinking and, among other things, invites public comment. As a draft upon which EPA invites comment, the discussion of existing regulations does not represent the consummation of the Agency's decision-making on the matters discussed. By its terms, the Draft Report itself does not impose binding requirements on any party. The regulations themselves, not the Draft Report, govern parties' legal obligations.

The primary contacts regarding questions or comments on this document are:

Elizabeth Kim U.S. Environmental Protection Agency Oceans and Coastal Protection Division, OWOW (4504T) 1200 Pennsylvania Avenue, NW Washington, DC 20460

(202) 566-1270 (telephone) (202) 566-1546 (fax) kim.elizabeth@epa.gov

and

Laura Johnson U.S. Environmental Protection Agency Oceans and Coastal Protection Division, OWOW (4504T) 1200 Pennsylvania Avenue, NW Washington, DC 20460

(202) 566-1273 (telephone) (202) 566-1546 (fax) johnson.laura-s@epa.gov

TABLE OF CONTENTS

Section 1: Introduction	
1.1 Overview	1-1
1.2 Other EPA Cruise Ship Efforts	
1.3 Cruise Ship Industry Efforts to Reduce Potential Environmental Impacts	1-4
References	1-6
Section 2: Sewage	2.1
2.1 What is sewage from vessels and how much is generated on cruise ships?	
2.2 What laws apply to sewage from cruise ships?	
2.3 How do cruise ships treat sewage?	2-6
2.4 What are the potential environmental impacts associated with sewage	2.22
from cruise ships?	2-22
2.5 What actions is the federal government taking to address sewage from	• •
cruise ships?	
References	2-4]
Section 3: Graywater	
3.1 What is graywater and how much is generated on cruise ships?	
3.2 What laws apply to graywater from cruise ships?	
3.3 Characterization of untreated graywater	3-4
3.4 What are the potential environmental impacts associated with untreated	
graywater from cruise ships?	3-19
3.5 What action is the federal government taking to address graywater waste	
streams from cruise ships?	
References	3-31
Section 4. Oily Pilge Weter	
Section 4: Oily Bilge Water 4.1 What is bilge water and how much is generated on cruise ships?	1.1
4.1 What is onge water and now much is generated on cruise ships?	
4.3 How do cruise ships manage bilge water?	4-0
4.4 What are the potential environmental impacts associated with inadequately	1 0
treated bilge water from cruise ships?	
4.5 What action is the federal government taking to address bilge water from	
cruise ships?	
References	4-1
Section 5: Solid Waste	
5.1 What is solid waste and how much is generated on cruise ships?	5_1
5.2 What laws apply to solid waste from cruise ships?	
5.2 What laws apply to solid waste from cruise ships? 5.3 How do cruise ships manage solid waste?	
5.4 What are the potential environmental impacts associated with solid waste	5-1
from cruise ships?	5.0
5.5 What action is the federal government taking to address solid waste from	,5-9
cruise ships?	5-10
VI 111-3V (-31111-63)	

References	5-12
Section 6: Hazardous Waste	
6.1 What is hazardous waste and how much is generated on cruise ships?	6-1
6.2 What laws apply to hazardous waste on cruise ships?	6-3
6.3 How do cruise ships manage hazardous waste?	6-7
6.4 What are the potential environmental impacts associated with hazardous	
waste from cruise ships?	6-9
6.5 What action is the federal government taking to address hazardous waste	
from cruise ships?	6-10
References	6-11

LIST OF FIGURES AND TABLES

Figure 2-1. Per Capita Sewage Generation as Reported in EPA's 2004 Cruise	
Ship Survey	2-2
Figure 2-2. Sewage Generation by Persons Onboard as Reported in EPA's	
2004 Cruise Ship Survey	2-2
Figure 2-3. Simplified Schematic of Traditional Type II Marine Sanitation	
Device Using Biological Treatment and Chlorine Disinfection	2-7
Table 2-1. Comparison of Traditional Type II MSD Effluent Concentrations	
to Untreated Domestic Wastewater–Conventional Pollutants and Other	
Common Analytes	
Table 2-2. Traditional Type II MSD Effluent Concentrations–Metals	2-10
Table 2-3. Traditional Type II MSD Effluent Concentrations—Volatile and	
Semivolatile Organics	2-10
Table 2-4. Comparison of Traditional Type II MSD Effluent Concentrations	
to Untreated Domestic Wastewater–Ammonia	
Table 2-5. AWT Effluent Concentrations and Removals—Pathogen Indicators	2-14
Table 2-6. AWT Effluent Concentrations and Removals—Conventional Pollutants	
and Other Common Analytes	
Table 2-7. AWT Effluent Concentrations and Removals—Metals	2-17
Table 2-8. AWT Effluent Concentrations and Removals–Volatile and Semivolatile	2 10
Organics	
Table 2-9. AWT Effluent Concentrations and Removals–Nutrients	
Table 2-10. AWT Sludge Concentrations for Selected Analytes	2-21
Table 2-11. Comparison of AWT and Traditional Type II MSD Effluent to	2.22
Wastewater Discharge Standards	
Table 2-12. National Recommended Water Quality Criteria for Bacteria	2-23
Table 2-13. Narrative National Recommended Water Quality Criteria for	2.26
Conventional Pollutants and Other Common Analytes	
Table 2-14. Seasonal Coastal Water Temperatures in C Across the United States Table 2-15. Comparison of Traditional Type II MSD and AWT Effluent to	2-20
Numeric National Recommended Water Quality Criteria for Total Residual	
Chlorine	2-29
Table 2-16. Comparison of AWT Effluent to National Recommended Water	2-27
Quality Criteria for Metals	2-30
Table 2-17. Comparison of Traditional Type II MSD Effluent to National	2 30
Recommended Water Quality Criteria for Semivolatile and Volatile Organics	2-30
Table 2-18. Comparison of AWT Effluent to National Recommended Water	2 30
Quality Criteria for Semivolatile and Volatile Organics	2-31
Table 2-19. Ammonia Concentration in Traditional Type II MSD and AWT	2 01
Effluent	2-32
Table 2-20. Calculated Ammonia NRWQC for Some Cruise Ship Ports of Call	
in the United States	2-32
Table 2-21. Hawaii Nutrient Criteria Values Which the Geometric Mean of	
Samples Is Not to Exceed	2-34

Table 3-1. Graywater Definitions	3-1
Table 3-2. Common Sources and Characteristics of Graywater	3-1
Figure 3-1. Per Capita Graywater Generation as Reported in EPA's 2004 Cruise	
Ship Survey	3-2
Figure 3-2. Graywater Generation by Persons Onboard as Reported in EPA's	
2004 Cruise Ship Survey	3-2
Table 3-3. Comparison of Untreated Graywater Concentrations to Untreated	
Domestic Wastewater—Pathogen Indicators	3-7
Table 3-4. Comparison of Untreated Graywater Concentrations to Untreated	
Domestic Wastewater—Conventional Pollutants and Other Common Analytes	3-9
Table 3-5. Untreated Graywater Concentrations—Metals	3-12
Table 3-6. Untreated Graywater Concentrations—Volatile and Semivolatile	
Organics	3-16
Table 3-7. Comparison of Untreated Graywater Concentrations to Untreated	
Domestic Wastewater—Nutrients	3-18
Table 3-8. Comparison of Untreated Cruise Ship Graywater to Wastewater	
Discharge Standards	3-19
Table 3-9. National Recommended Water Quality Criteria for Bacteria	
Table 3-10. EPA and ACSI Untreated Cruise Ship Graywater Pathogen	
Indicator Data	3-22
Table 3-11. Narrative National Recommended Water Quality Criteria for	
Conventional Pollutants and Other Common Analytes	3-22
Table 3-12. Seasonal Coastal Water Temperatures in °C Across the United	
States	3-24
Table 3-13. Comparison of Untreated Cruise Ship Graywater to Numeric	
National Recommended Water Quality Criteria for Total Residual Chlorine	3-25
Table 3-14. Comparison of Untreated Cruise Ship Graywater to National	
Recommended Water Quality Criteria for Metals	3-26
Table 3-15. Comparison of Untreated Cruise Ship Graywater to National	
Recommended Water Quality Criteria for Semivolatile and Volatile Organics	3-26
Table 3-16. Ammonia Concentration in Untreated Graywater	3-27
Table 3-17. Calculated Ammonia NRWQC for Some Cruise Ship Ports of	
Call in the United States	3-28
Table 4-1. Maximum Daily Volume of Bilge Water Production	4-2
Table 4-2. Oily Water Separator Technologies	4-7
Table 5-1. Types and Specific Examples/Descriptions of Solid Waste Generated	
on Cruise Ships	5-2
Table 5-2. Estimates of Solid Waste Generated Per Vessel per Week	5-2
Table 5-3. Estimates of Solid Waste Generated per Person per Day on a Cruise	
Ship	5-3
Table 5-4. Summary of Garbage Discharge Restrictions for Vessels	5-5
Table 5-5. Waste Management Practices by Royal Caribbean Cruises	
Table 5-6. Amount of Time for Objects to Dissolve at Sea	

Table 6-1. Types of Potentially Hazardous Waste Generated Aboard Cruise	
Ships	6-1
Table 6-2. Estimates of Hazardous Waste Generated Onboard Holland	
America Lines Fleet Per Week	6-3
Table 6-3. Classification System and Accumulation Limits for Hazardous	
Waste Generators	6-5